Space Weather Technical Forecast

Issued on Saturday, 20 November 2021 at 00:40 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of G1/Minor geomagnetic storms this weekend.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity was Very Low over the last 24 hours, with no significant X-ray flare activity observed at GOES 16. There are two active sunspot regions on the visible disc: AR2896 and AR2897, which are both small and stable unipolar Hsx/Alpha regions located in the eastern hemisphere.

No Earth-directed Coronal Mass Ejections (CMEs) have been observed in available imagery.

Solar Wind / Geomagnetic Activity: The solar wind speed, as measured by DSCOVR and ACE at L1, started the period at elevated levels, around 500 km/s, then gradually declined by the end of the period to slightly elevated, around 430 km/s. The solar wind density was predominantly at average levels. The IMF Bt was weak and very stable between 3-5nT, with only weak deflections of +4/-4 nT in the Bz. The phi angle was entirely negative (towards the Sun). Geomagnetic activity was Quiet (Kp 0-2).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) as measured by GOES-16 remained at Background levels.The high energy electron flux (greater than 2 MeV) was predominantly at Moderate levels, peaking at 643 pfu at 19/2020 UTC. The associated 24-hour integrated fluence remained below the Active threshold (1e8 integrated pfu), with a slow rising trend, reaching 1.87e7 integrated pfu at 20/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to be Very Low, with a Slight Chance of C-class flares.

Solar Wind / Geomagnetic Activity: There are no Earth-directed CMEs in the current forecast. The next coronal hole high speed stream is expected to arrive during the second half of day 1 (20th). Geomagnetic activity is expected to be Quiet initially before increasing to predominantly Unsettled to Active (Kp 3-4) later on day 1 (20th), with a chance of isolated G1/Minor (Kp 5) geomagnetic storms. Similar conditions are likely to start day 2 (21st) with coronal hole effects then expected to gradually ease through days 3 and 4 (22nd and 23rd), bringing an eventual return to mainly Quiet conditions by the end of the period.

Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux is expected to be at Background levels.

The high energy electron flux (greater than 2 MeV) is expected to to rise under HSS influence. This brings an increasing chance of reaching the High threshold (1000 pfu) from day 2 (21st).The corresponding fluence is likely to have an increasing trend through the period, with an increasing chance of reaching the Active (1e8 integrated flux), on days 3 and 4 (22nd and 23rd).

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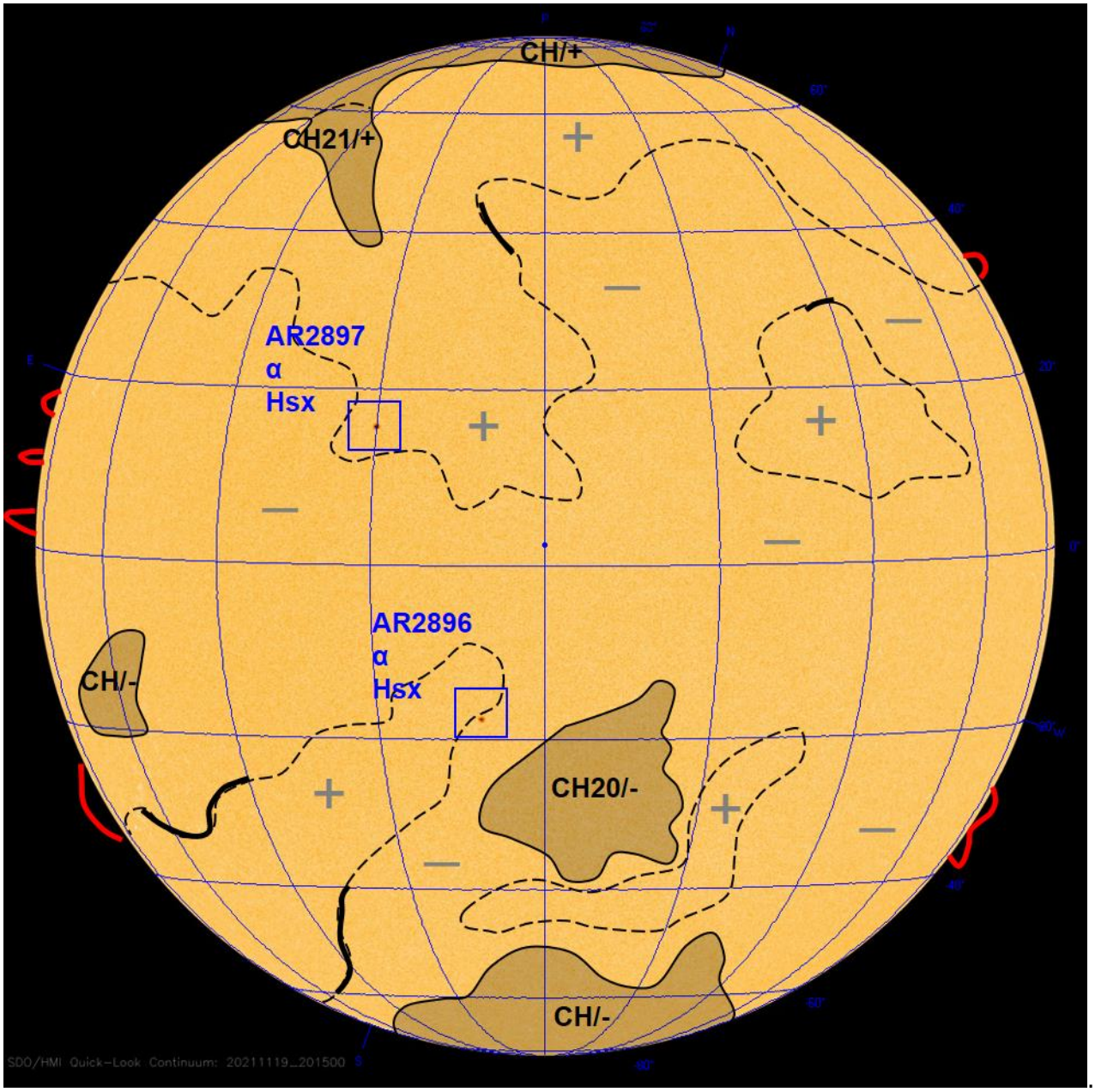
Figure 1. Solar Analysis Valid 19/2000 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

There are no Earth-directed CMEs that feature in the current forecast.

Currently, using a compromise between STEREO A measurements and Enlil, an onset of the HSS from CH20 is expected during the second half UTC of day 1 (20th). Looking at the STEREO A data, strong speeds with speeds between 600-750km/s are possible. Therefore, despite approaching the semi-annual minimum in coronal hole potency, there remains a Chance of G1, possibly peaking as the feature matures into day 2 (21st).

Geomagnetic activity is expected to be Quiet initially before increasing to predominantly Unsettled to Active (Kp 3-4) later on day 1 (20th), with a chance of isolated G1/Minor (Kp 5) geomagnetic storms. Similar conditions are likely to start day 2 (21st) with coronal hole effects then expected to gradually ease through days 3 and 4 (22nd and 23rd), bringing an eventual return to mainly Quiet conditions by the end of the period.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	50	50	20	5
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

None expected.

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Met Office Space Weather Technical Forecast

Radio Blackouts - X-Ray Flares:

There are currently two active sunspot regions on the visible disc; AR2896 and AR2897. Both are simple, stable and unipolar spots.

Neither region will rotate off the visible disc during the forecast period. STEREO A EUVI imagery does not indicate that any significant regions will arrive from the farside through the period. Therefore Very Low solar activity is forecast, with a slight chance (10%) of C-class flares.

X Ray Flares / Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	No	1	1	1	1
Very Active	R3 to R5 X Class	No	1	1	1	1

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) as measured by GOES-16, remained at Background levels during the previous 24 hours, and is currently forecast to remain at this level through the period.

Radiation Storms / Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	1	1	1	1
Very Active	≥ S3 *	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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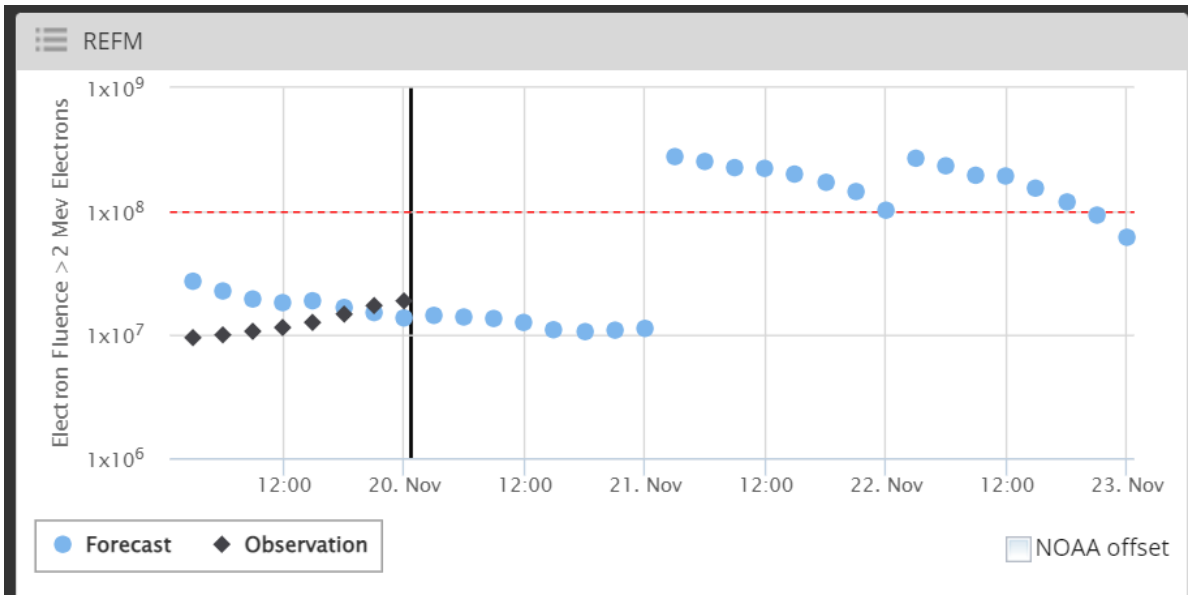
High Energy Electrons Event (≥ 2MeV):

The high energy electron flux (greater than 2 MeV) has been at mainly moderate levels today (19th). The anticipated onset of CH20/- later on day 1 (20th) is likely to temporarily suppress flux levels before they then begin to rise under HSS influence. This brings an increasing chance of reaching the High threshold (1000 pfu) from day 2 (21st).

The corresponding fluence is likely to have an increasing trend through the period, with an increasing chance of reaching the Active (1e8 integrated flux), on days 3 and 4 (22nd and 23rd). The Met Office REFM model shows the fluence following an upward trend, eventually breaching the Active threshold. The overall trend is considered good guidance, however there is uncertainty regarding precisely when Active fluence may be reached, this is more likely as the period progresses once HSS has been established.

GEO Electron Environment	Level ($cm^{-2}\ sr^{-1}\ day^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ $1x10^8$	No	10	30	50	60
Very Active	≥ 2 MeV ≥ $1x10^9$	No	1	1	5	5

Figure 2: MOSWOC REFM.



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